

Percutaneous Treatment of a Sacral Metastasis with Combined Embolization, Cryoablation, Alcohol Ablation and Sacroplasty for Local Tumor and Pain Control

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Summary

Multiple treatment options have been introduced for the treatment of sacral tumoral bone pain. These options include pre-operative sacral embolization, percutaneous cryoablation, alcohol ablation, and sacroplasty. We intend to show that in the correct clinical scenario, a combination of the four procedures performed as a two-stage process can effectively treat tumoral bone pain refractory to medical therapy.

Introduction

Multiple treatment options have been introduced for the treatment of sacral tumoral bone pain. These options include pre-operative sacral embolization¹, percutaneous cryoablation^{2,3}, alcohol ablation⁴, and sacroplasty⁵⁻⁸. In the correct clinical scenario, a combination of the four procedures performed as a two-stage process can effectively treat tumoral bone pain refractory to medical therapy.

Case Report

A 71-year-old man with a medical history of metastatic renal cell carcinoma (RCC) presented with progressive severe low back pain and

mild bilateral lower extremity paresthesias attributable to sacral metastasis. The severe pain had continued despite conservative medical therapy.

MRI demonstrated a large sacral lytic lesion with pathologic fractures and soft tissue extension into the sacral neuroforamina (Figure 1).

In light of the patient being a poor surgical candidate, percutaneous sacral cryoablation coupled with alcohol ablation followed by sacroplasty was planned to treat both tumoral and bone pain from pathologic fractures. Due to the hypervascularity of RCC metastasis, pre-ablation sacral embolization with polyvinyl alcohol (PVA) was planned on the day prior to percutaneous treatment. Percutaneous embolization of bilateral lateral sacral branches of the iliolumbar arteries and the median sacral artery supply to the sacral metastasis was performed under moderate sedation. The right and left lateral sacral branches and the median sacral artery were suprasedlected with a Renegade microcatheter and Synchro wire (Figure 2). Neurological testing was performed at each vessel with 5 mg of Sodium Brevital prior to embolization. There were no changes in lower extremity sensory/motor signals or rectal tone. Each vessel was embolized with a combination of 150-250 and 250-350 micron PVA particles (Figure 3). Follow-up angiograms showed devascularization of the sacral metastasis.

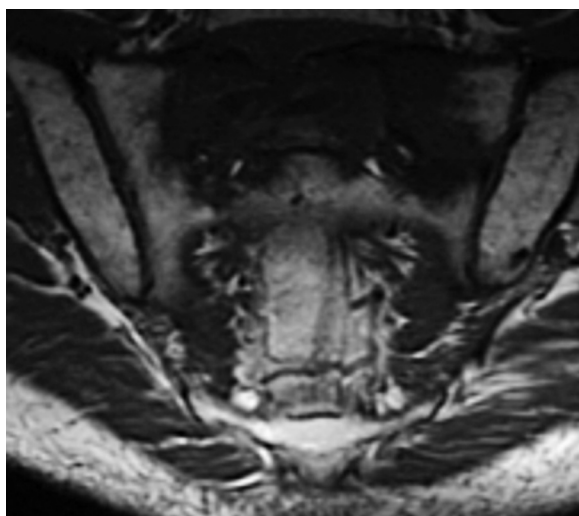


Figure 1 Axial T1-weighted MRI image of the sacrum demonstrates a large metastatic lesion to the patient's anterior sacrum.



Figure 4 Axial CT image through the sacrum with the patient in the prone position demonstrating bilateral cryoablation probes and a temperature probe placed within the left S1 sacral neuroforamina. Cryoablation was performed under real-time temperature monitoring.



Figure 5 Axial CT image through the sacrum with the patient in the prone position after the injection of methyl methacrylate for sacroplasty.

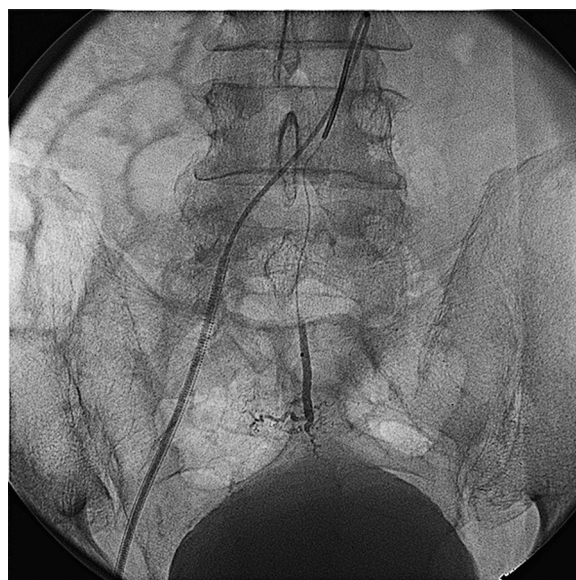


Figure 2 The median sacral artery is suprasedlected and the angiogram demonstrates the vascular supply to the sacral lesion.

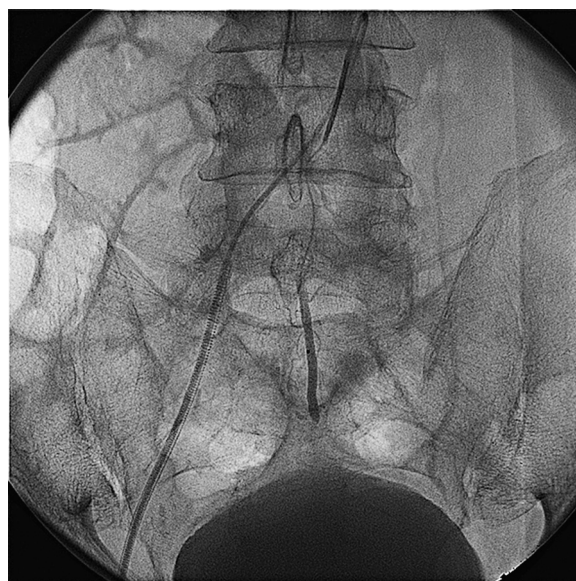


Figure 3 The median sacral artery is embolized with a combination of 150-250 and 250-350 micron polyvinyl alcohol particles.

The following day, cryoablation under general anesthesia was performed with the patient prone. Bilateral 10-gauge bone biopsy needles serving as introducers were inserted into the sacral lesion, and 15 mm cryoablation probes were inserted through each introducer away from the sacral neuroforamina. Real-time tem-

perature monitoring was accomplished with a temperature probe placed in the left S1 sacral neuroforamina (Figure 4). Once positioning had been verified, a single freeze, thaw, and freeze cycle was performed for ten, eight, and ten minutes, respectively. This resulted in the formation of ovoid ice balls within the boundaries of the sacral metastasis. While the measured temperature of the cryoablation probe central zone reached -40°C , the neuroforaminal temperature probe never dropped below 34°C .

Sacral alcohol ablation was subsequently accomplished with 4 cc of absolute alcohol slowly injected into both 10 gauge needles to reach portions of the tumor not affected by cryoablation.

Sacroplasty was then performed with injection of methyl methacrylate into both 10 gauge needles (Figure 5). The sacral lytic metastasis was filled with cement under rapid CT guidance. There was no extravasation of cement into the sacral neuroforamina or central canal. The needles were removed and adequate hemostasis was achieved using manual compression.

The patient was seen the following day with a subjective improvement of bone pain but no change in the mild tingling and numbness felt in both lower extremities. By post-operative day 2, the patient admitted to being able to walk with assistance and that the back pain had decreased significantly. At one week post-operatively, the patient complained of unilateral right-sided pain and tingling. The patient was started on a short course of steroids and NSAIDs. On subsequent follow-up, the pain and neurologic symptoms had resolved.

Discussion

Patients with sacral tumors generally present with symptoms including pain, neurological deficits, and palpable mass due to mass effect caused by tumoral destruction and expansion. Multiple techniques have been described in the symptomatic treatment of both primary and metastatic sacral tumors. Pre-operative sacral embolization has been performed prior to surgical resection of vascular neoplasms¹. While en-bloc resection of the sacrum was not planned, pre-operative sacral embolization was performed given the large sacral tumor volume and the vascular nature of the renal metastasis.

Prior experience shows that percutaneous cryoablation is effective in palliating tumoral bone pain³. Percutaneous cryoablation is the

preferred ablative technique over radiofrequency ablation due to its ability to provide precise control over image-guided placement of the ice ball². This is particularly important given the sensitive neural and vascular structures exiting through sacral neuroforamina.

While alcohol ablation has analgesic properties when treating bone tumors, thermal ablation is favoured due to more predictable ablation zones given the unpredictable distribution of infused ethanol⁴. For this treatment, however, percutaneous cryoablation was not able to cover the entire tumor mass. Therefore, alcohol was used in the hope of ablating areas not covered by cryoablation in spite of the poor predictability of ethanol distribution. The possibility of vascular and neurologic injury secondary to ethanol injection was discussed prior to the procedure.

Sacroplasty with intraosseous administration of methyl methacrylate has been shown to effectively treat sacral metastatic insufficiency fractures⁵⁻⁸. Studies have also shown that sacroplasty in conjunction with thermal ablation produces significant pain improvement in cases of bone tumor with soft tissue extension⁶.

Adequate neurological monitoring of regional neurovascular structures is essential for technical and clinical success of the procedure. This is routinely performed for thermal ablation, but in our procedure, continuous monitoring was also performed during the injection of ethanol.

Given the extensive disease, a combination of pre-ablative embolization, sacral cryoablation and alcohol ablation, followed by sacroplasty was decided. From a technical standpoint, the procedure was successful. The most worrisome potential consequence of the four-part procedure involved the use of alcohol ablation given the unpredictable nature of ethanol distribution. Our patient complained of temporary pain and neurologic symptoms one week post-operatively, which subsided after a course of steroids and NSAIDs. This is thought to be due to tumoral expansion from recent ablation with subsequent improvement post-steroid therapy.

Conclusions

Independently, pre-operative sacral embolization, percutaneous sacral cryoablation, ethanol ablation, and sacroplasty have been shown

to improve bone tumoral pain. When clinically appropriate, a combination of all four procedures performed in stages can effectively treat tumoral pain with improved quality of life. Fur-

ther studies need to be performed to assess the effectiveness of this approach in carefully selected patients with extensive sacral tumoral disease.

References

- 1 Gottfried ON, Schmidt MH, Stevens EA. Embolization of sacral tumors. *Neurosurg Focus*. 2003; 15 (2): E4.
- 2 Beland MD, Dupuy DE, Mayo-Smith WW. Percutaneous cryoablation of symptomatic extraabdominal metastatic disease: preliminary results. *Am J Roentgenol*. 2005; 184: 926-930.
- 3 Callstrom MR, Atwell TD, Charboneau JW, et al. Painful metastases involving bone: percutaneous image-guided cryoablation - Prospective trial interim analysis. *Radiology*. 2006; 241: 572-580.
- 4 Gangi A, Kastler B, Klinkert A, et al. Injection of alcohol into bone metastases under CT guidance. *J Comput Assist Tomogr*. 1994; 18: 932-935.
- 5 Shah RV. Sacral kyphoplasty for the treatment of painful sacral insufficiency fractures and metastases. *Spine J*. 2012; 12 (2): 113-20.
- 6 Buy X, Basile A, Bierry G, et al. Saline infused bipolar radiofrequency ablation of high-risk spinal and paraspinal neoplasms. *Am J Roentgenol*. 2006; 186 (5): S322-S326.
- 7 Ambrosanio G, Lavanga A, Vassallo P, et al. Vertebroplasty in the treatment of spine disease. *Interv Neuroradiol*. 2005; 11: 309-323.
- 8 Toro A, Pulvirenti E, Manfrè L, et al. Sacroplasty in a patient with bone metastases from hepatocellular carcinoma. A case report. *Tumori*. 2010; 96 (1): 172-174.

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